What is claimed is:

1. A traveling-wave electroabsorption modulator configured to function simultaneously as a photodetector, a demultiplexer, and an optical pulse generator for clock-recovery and demultiplexing.

2. An apparatus for simultaneous photodetection, demultiplexing and optical pulse generation, comprising;

a traveling-wave electroabsorption modulator; and

a phase-locked loop (PLL) coupled to said traveling-wave electroabsorption modulator;

wherein said traveling-wave electroabsorption modulator and said PLL are configured for simultaneous photodetection, demultiplexing and optical pulse generation at a line rate on the order of 40 Gb/s.

3. An apparatus as recited in claim 2, wherein said traveling-wave electroabsorption modulator includes a first port coupled to the PLL for outputting a photocurrent and a second port coupled to the PLL, wherein the photocurrent from the first port of said traveling-wave electroabsorption modulator provides a tone to said PLL, and wherein said PLL provides a recovered electrical clock signal to the second port of said traveling-wave electroabsorption modulator.

4. An apparatus for simultaneous photodetection, demultiplexing and optical pulse generation, comprising:

a traveling-wave electroabsorption modulator; and

a phase-locked loop (PLL) coupled to said traveling-wave electroabsorption

modulator;

wherein said traveling-wave electroabsorption modulator and said PLL provide simultaneous photodetection, demultiplexing and optical pulse generation at a line rate on the order of 40 Gb/s.

5. An apparatus as recited in claim 4, wherein said traveling-wave electroabsorption modulator includes a first port coupled to the PLL for outputting a photocurrent and a second port coupled to the PLL, wherein the photocurrent from the first port of said traveling-wave electroabsorption modulator provides a tone to said PLL, and wherein said PLL provides a recovered electrical clock signal to the second port of said traveling-wave electroabsorption modulator.

6. An apparatus for simultaneous photodetection, demultiplexing and optical pulse generation, comprising:

a first traveling-wave electroabsorption modulator;

a second traveling-wave electroabsorption modulator in series with said first traveling-wave electroabsorption modulator; and

a phase-locked loop (PLL) coupled to said second traveling-wave electroabsorption modulator;

wherein said first and second traveling-wave electroabsorption modulators and said PLL provide simultaneous photodetection, demultiplexing and optical pulse generation at a line rate on the order of 160Gb/s.

7. An apparatus as recited in claim 6, wherein said first traveling-wave electroabsorption modulator includes a port coupled to said second traveling-wave

electroabsorption modulator, and said second traveling-wave electroabsorption modulator includes a first port coupled to the PLL for outputting a photocurrent and a second port coupled to the PLL, wherein the photocurrent from the first port of said second traveling-wave electroabsorption modulator provides a tone to said PLL, and wherein said PLL provides a recovered electrical clock signal to the second port of said second traveling-wave electroabsorption modulator and to the port of said first traveling-wave electroabsorption modulator.

8. A clock recovery apparatus for an all-optical 3R regenerator, comprising:

a traveling-wave electroabsorption modulator configured for optical clock recovery and outputting of a recovered optical clock signal to an all-optical 3R regenerator.

9. An apparatus for optical clock recovery, comprising:

a traveling-wave electroabsorption modulator; and

a phase-locked loop (PLL) coupled to said traveling-wave electroabsorption modulator;

wherein photocurrent of the traveling-wave electroabsorption modulator is used to detect data and recover an electrical clock through the PLL;

wherein the recovered electrical clock is used to modulate the traveling-wave electroabsorption modulator and generate an optical clock at a different wavelength;

whereby said traveling-wave electroabsorption modulator operates simultaneously as a photodiode and a pulse generator.

10. An apparatus as recited in claim 9, wherein said traveling-wave electroabsorption modulator includes a first port coupled to the PLL for outputting a photocurrent and a second port coupled to the PLL, wherein the photocurrent from the first port of said traveling-wave electroabsorption modulator provides a tone to said PLL, and wherein said PLL provides a recovered electrical clock signal to a second port of said traveling-wave electroabsorption modulator.

11. An apparatus as recited in claim 9, wherein said optical clock is used for all optical 3R regeneration.

12. An apparatus for optical clock recovery, comprising:

a traveling-wave electroabsorption modulator; and

a phase-locked loop coupled to said traveling-wave electroabsorption modulator;

wherein photocurrent of the traveling-wave electroabsorption modulator is used to detect data and recover an electrical clock through the phase locked loop;

wherein the recovered electrical clock is used to modulate the traveling-wave electroabsorption modulator and generate an optical clock at a different wavelength;

wherein the photocurrent from a first port of said traveling-wave electroabsorption modulator provides a tone to said phase-locked loop;

wherein said phase locked loop provides a recovered electrical clock signal to a second port of said traveling-wave electroabsorption modulator;

whereby said traveling-wave electroabsorption modulator operates simultaneously as a photodiode and a pulse generator.

13. An apparatus as recited in claim 12, wherein said optical clock is used

for all optical 3R regeneration.

14. An apparatus for simultaneous demultiplexing and optical pulse generation, comprising;

a traveling-wave electroabsorption modulator (TW-EAM) including a first port for an optical input, a second port, a third port for an optical output, and a fourth port; and

a phase-locked loop (PLL) coupled to the TW-EAM, wherein the second port of the TW-EAM is coupled to an input of the PLL and the fourth port of the TW-EAM is coupled to an output of the PLL;

wherein when the TW-EAM receives at the first port OTDM data of a first bit rate with a first wavelength and a continuous wave with a second wavelength, the TW-EAM produces at the second port a photocurrent having a tone of a fundamental frequency determined by the first bit rate;

wherein in response to the photocurrent, the PLL generates an electrical clock with a first frequency that is supplied to the fourth terminal of the TW-EAM,

whereby the third terminal of the TW-EAM generates demultiplexed data of a second bit rate with the first wavelength and an optical clock with the first frequency and the second wavelength.

15. An apparatus defined in claim 14, wherein the TW-EAM functions as a photodetector and a modulator.

16. An apparatus defined in claim 14, wherein the first bit rate of the OTDM data is on an order of 40 Gb/s.

17. An apparatus defined in claim 14, wherein the first frequency is determined by dividing the fundamental frequency by N (where N is a natural number larger than 1).

18. An apparatus defined in claim 17, wherein the second bit rate is determined by dividing the first bit rate by N.

19. An apparatus defined in claim 14, wherein the PLL includes a band-pass filter for eliminating the tone.

20. An apparatus defined in claim 14, wherein the PLL includes a voltage controlled oscillator whose frequency is the same as the first frequency.

21. An apparatus for optical clock recovery, comprising;

a traveling-wave electroabsorption modulator (TW-EAM) including a first port for an optical input, a second port, a third port for an optical output, and a fourth port; and

a phase-locked loop (PLL) coupled to the TW-EAM, wherein the second port of the TW-EAM is coupled to an input of the PLL and the fourth port of the TW-EAM is coupled to an output of the PLL;

wherein when the TW-EAM receives at the first port OTDM data of a first bit rate with a first wavelength and a continuous wave with a second wavelength, the TW-EAM produces at the second port a photocurrent having a tone of a fundamental frequency determined by the first bit rate;

wherein in response to the photocurrent, the PLL generates an electrical clock

with a frequency that is the same as the fundamental frequency and is supplied to the fourth terminal of the TW-EAM,

whereby the third terminal of the TW-EAM generates an optical clock with the second frequency that is the same as the fundamental frequency.

22. An apparatus defined in claim 19, wherein the TW-EAM functions as a photodetector and a modulator.

23. An apparatus defined in claim 19, wherein the first bit rate of the OTDM data is on an order of 40 Gb/s.